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Kim

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(54) **PRINTING APPARATUS AND ELECTRONIC DEVICE HAVING LINE CONTACT STRUCTURE**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **B41J 2/01**; B41J 2/14; H01R 12/00; H01R 12/06

(52) **U.S. Cl.** **347/50**; 439/67

(58) **Field of Search** 347/49, 50; 439/66, 439/67, 493, 637; 29/830, 842

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(57) **ABSTRACT**

A contact structure for transferring an electrical signal from a main body to a print head, particularly a printing apparatus having a line contact structure, is provided. The printing apparatus comprises an electrical connecting portion formed at an end of the cable; a plurality of contact points formed at the electrical connecting portion, each in a form of a hollow projection so as to correspond to a circuit portion of the print head and having a hole form at an apex of the projection; a fixing portion for fixing the electrical connecting portion to the main body; and an elastic member interposed between the electrical connecting portion and the fixing portion and having a plurality of protruding portions corresponding to the plurality of contact points, wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the print head when the print head is mounted in the main body.

14 Claims, 6 Drawing Sheets

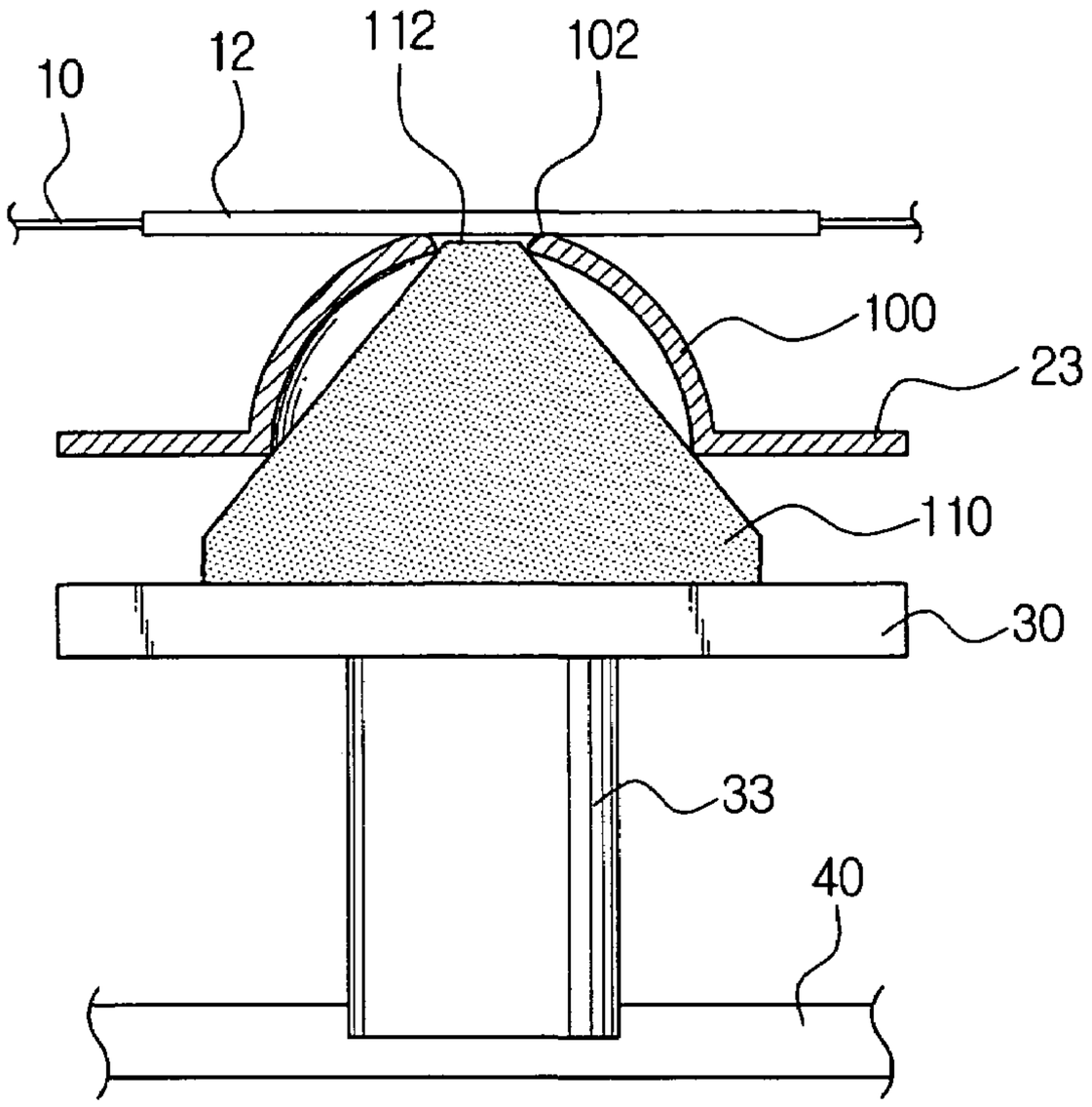


FIG. 1
(PRIOR ART)

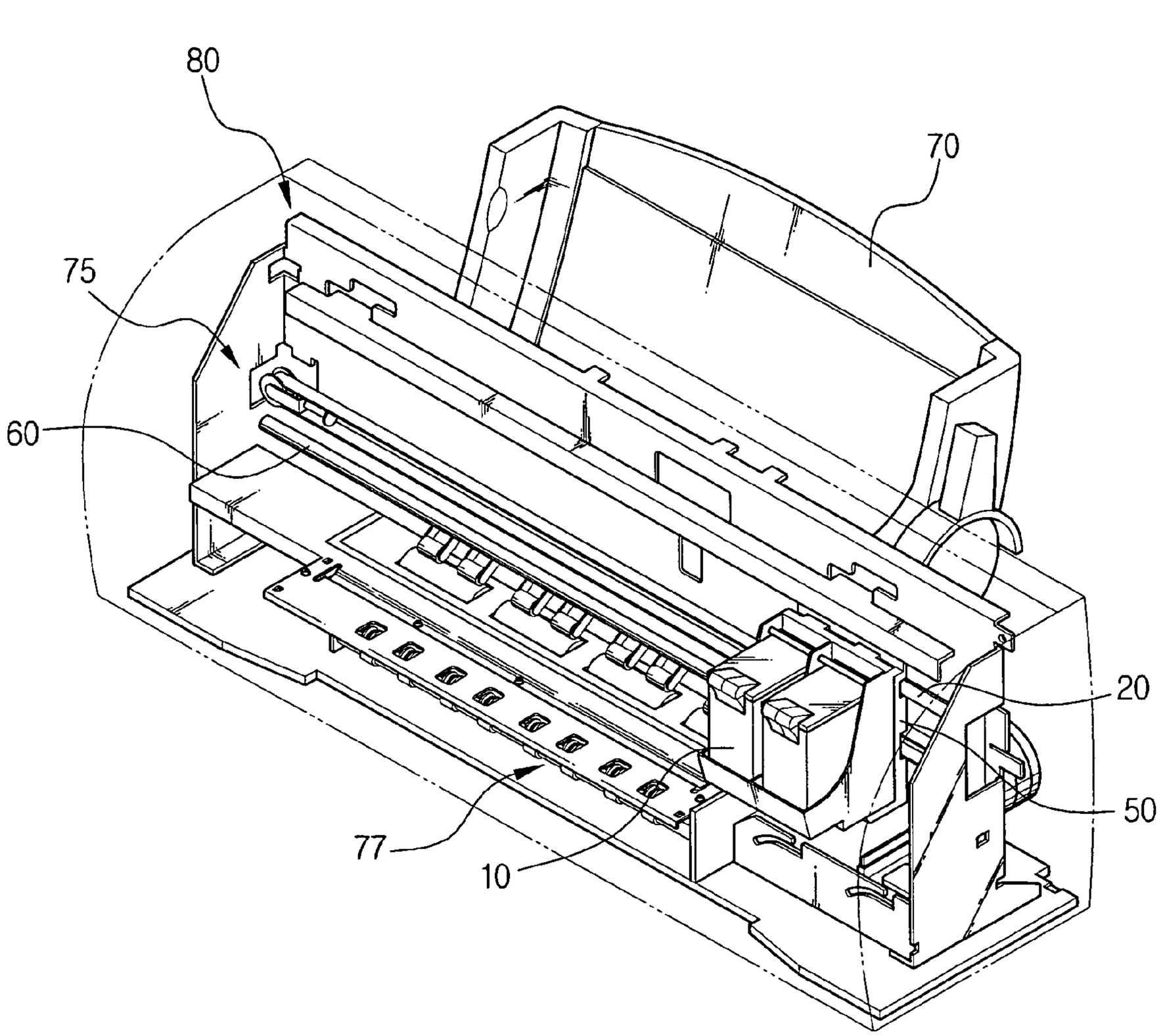


FIG. 2
(PRIOR ART)

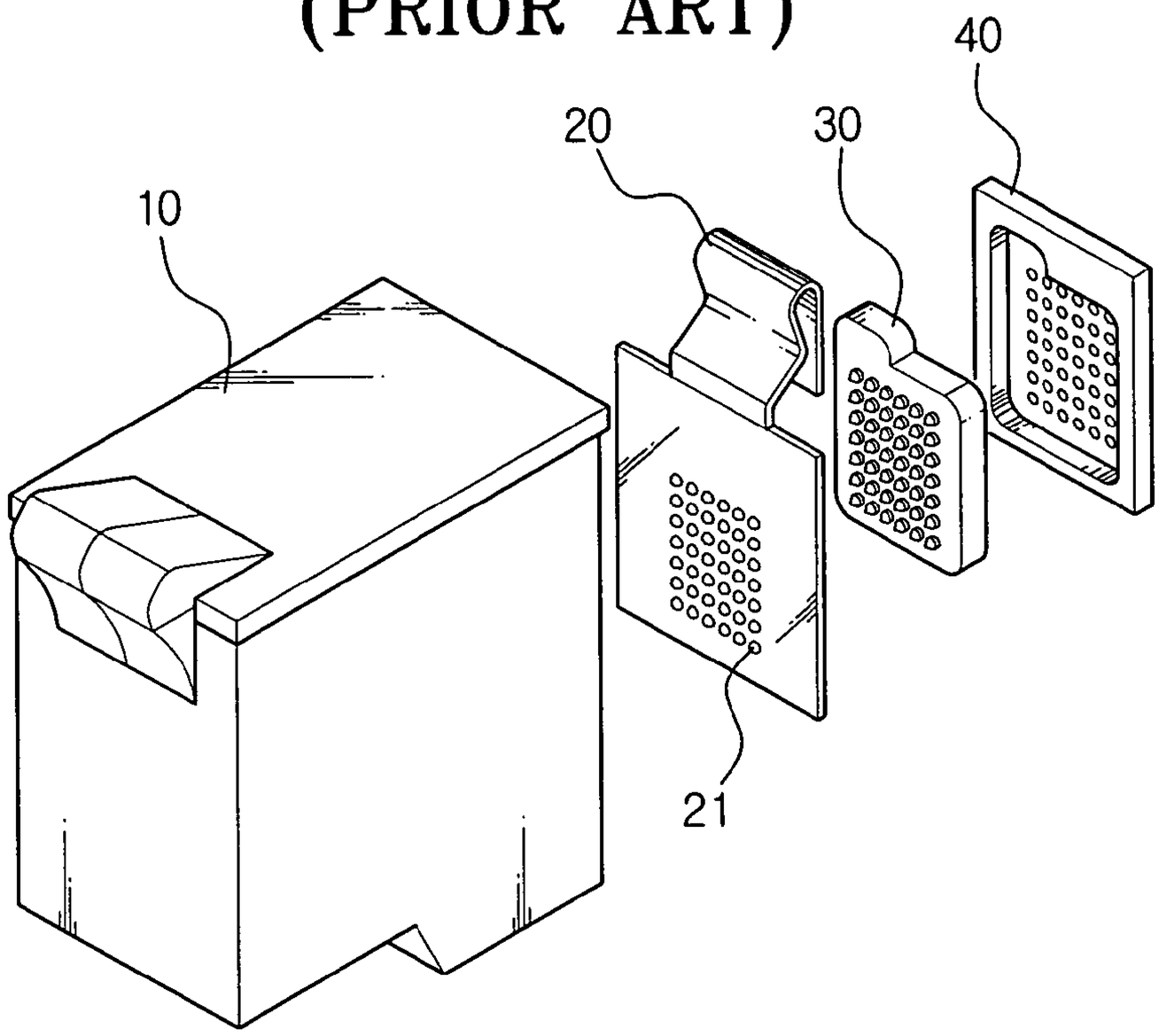


FIG. 3
(PRIOR ART)

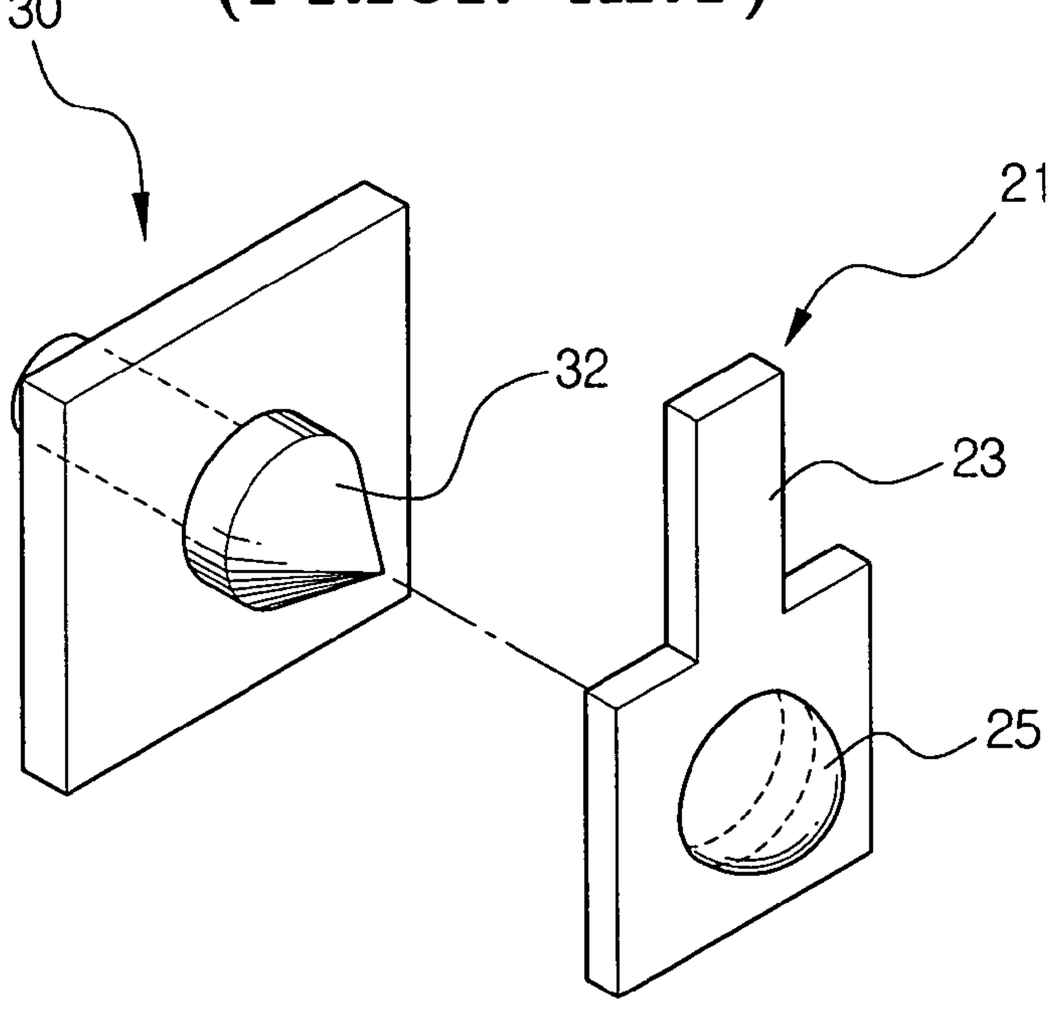


FIG. 4
(PRIOR ART)

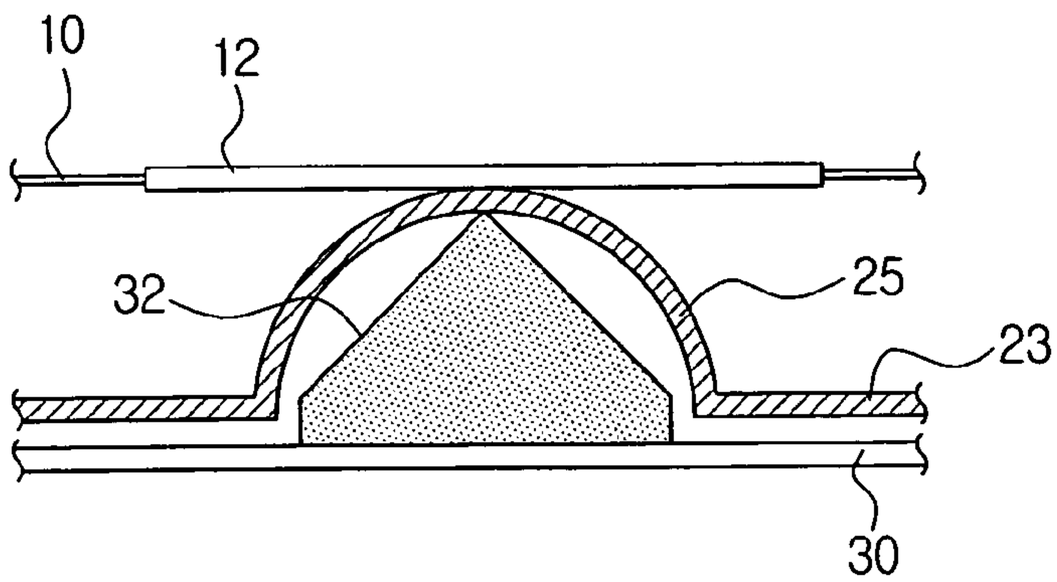


FIG. 5A
(PRIOR ART)

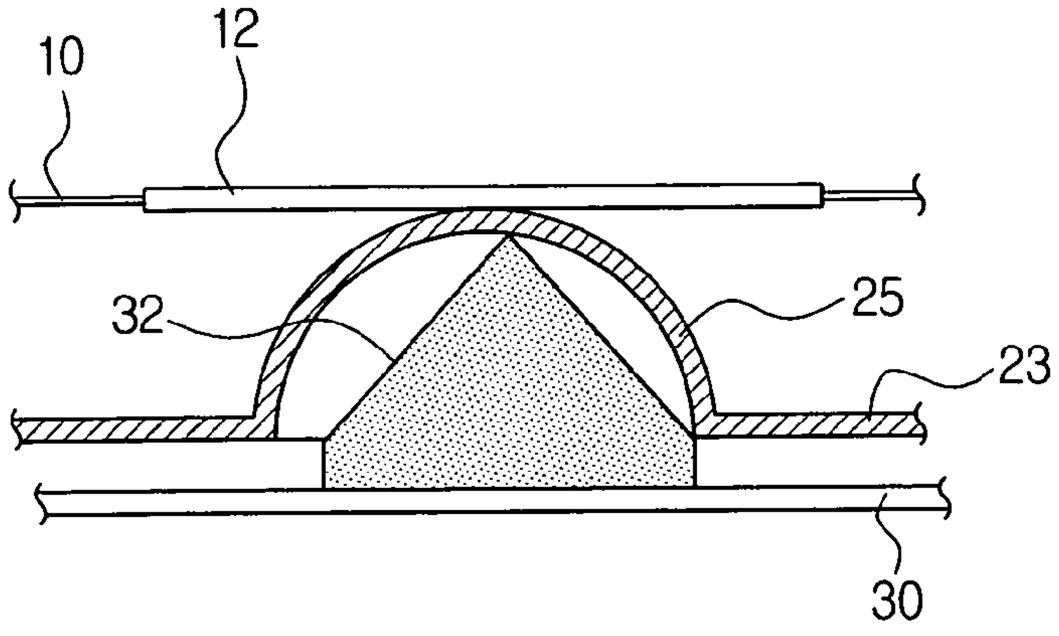


FIG. 5B
(PRIOR ART)

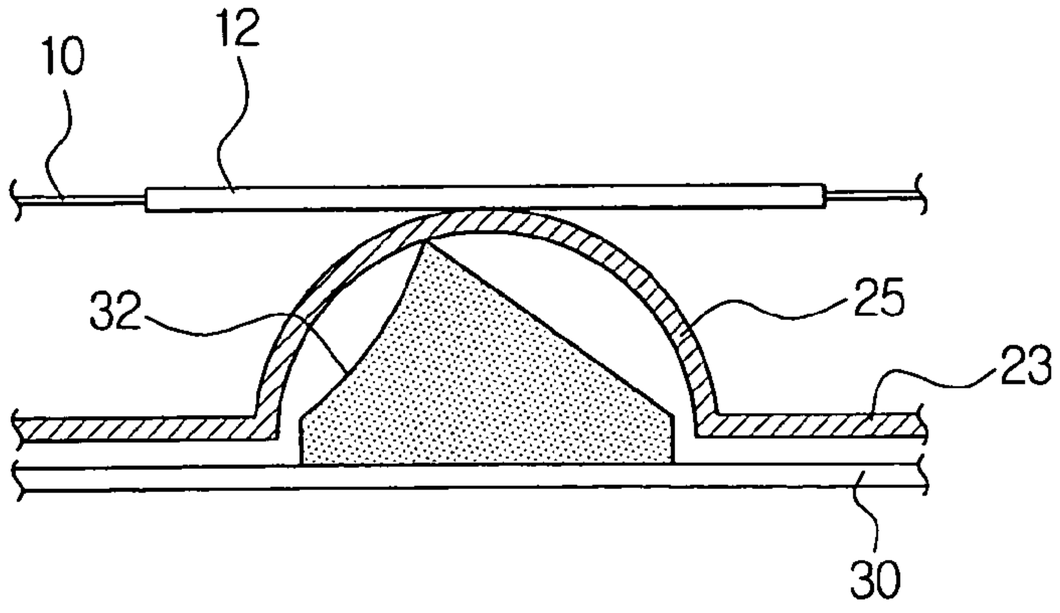


FIG. 6

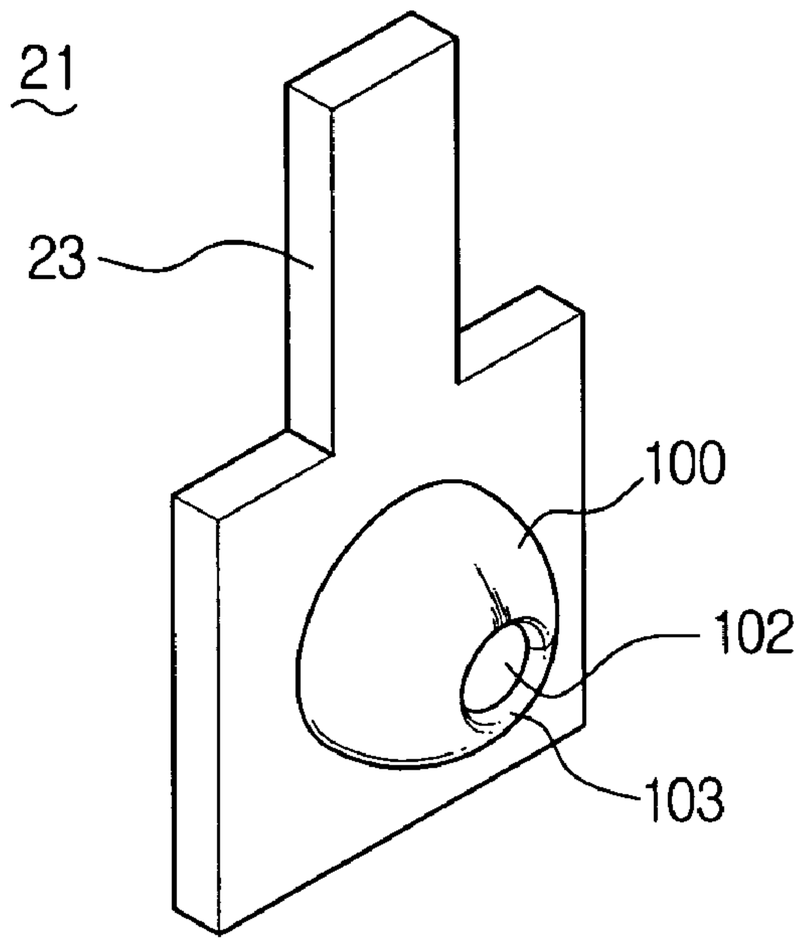


FIG. 7

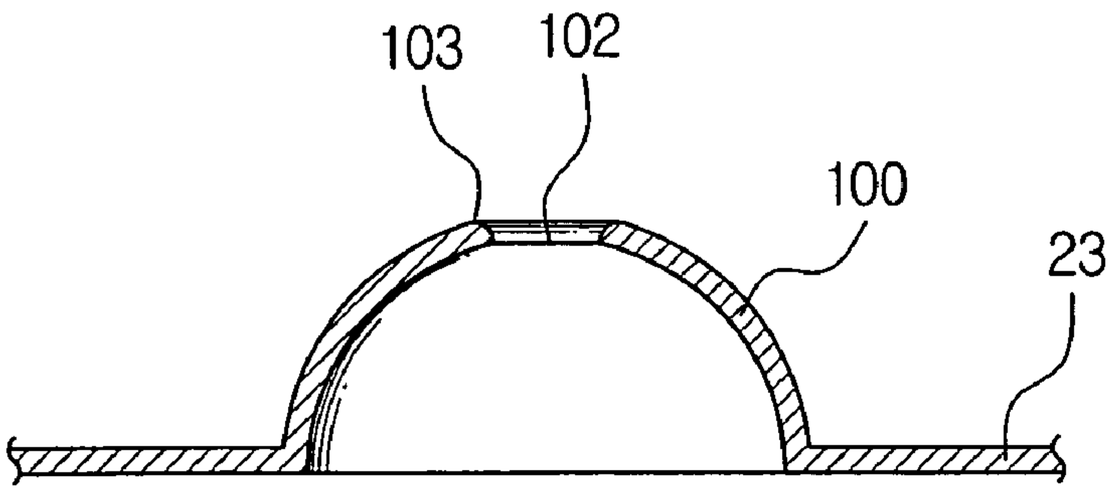


FIG. 8

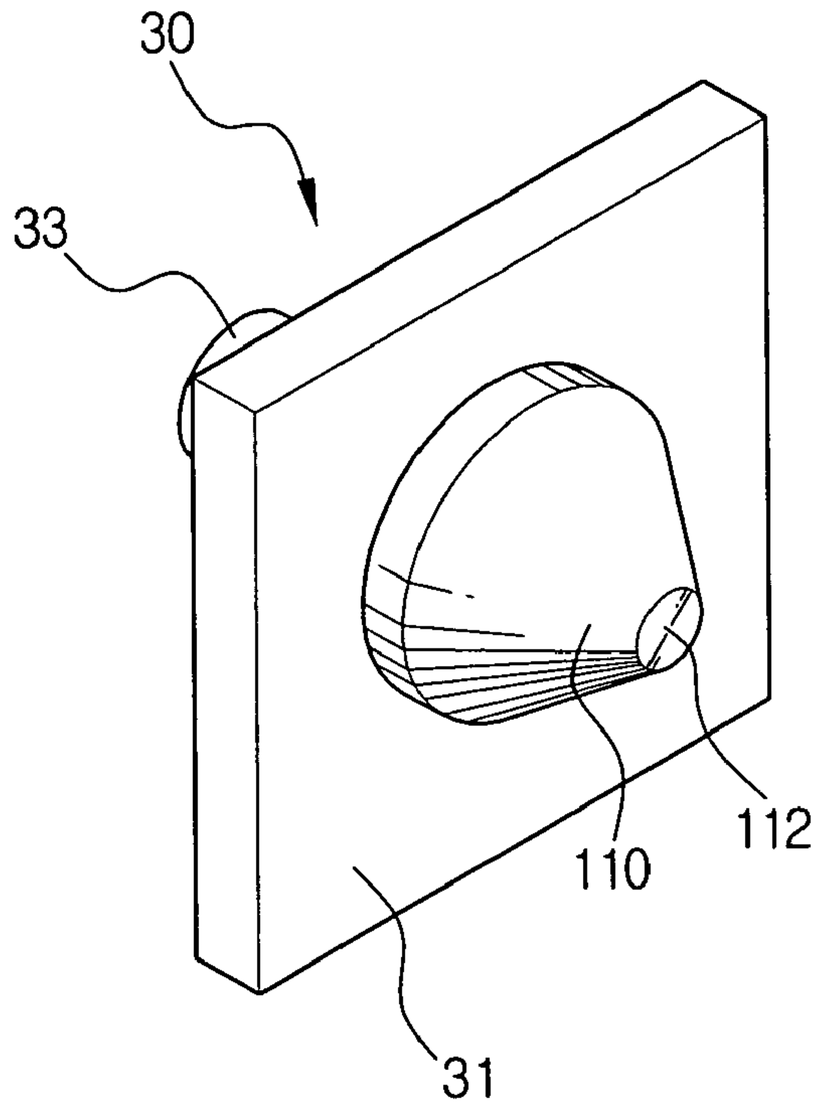


FIG. 9

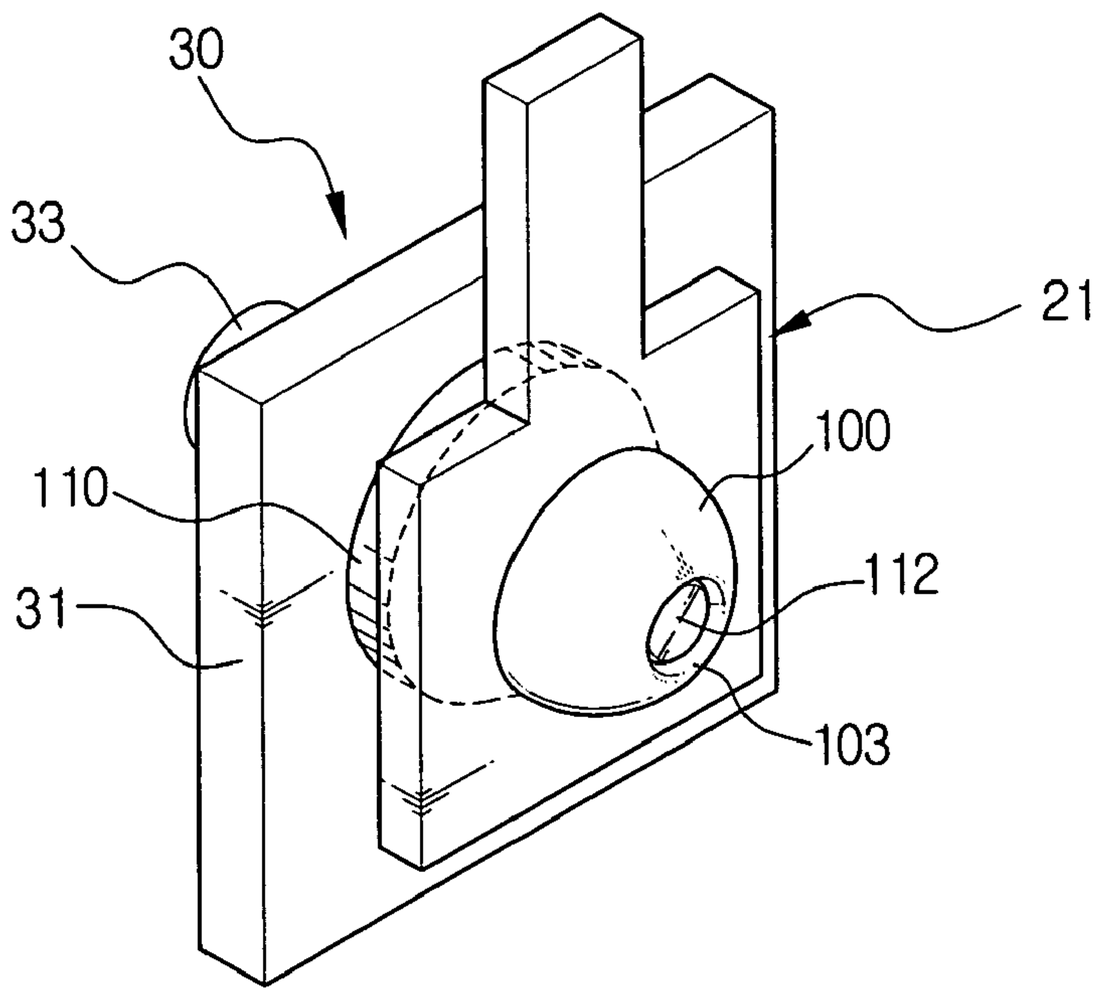
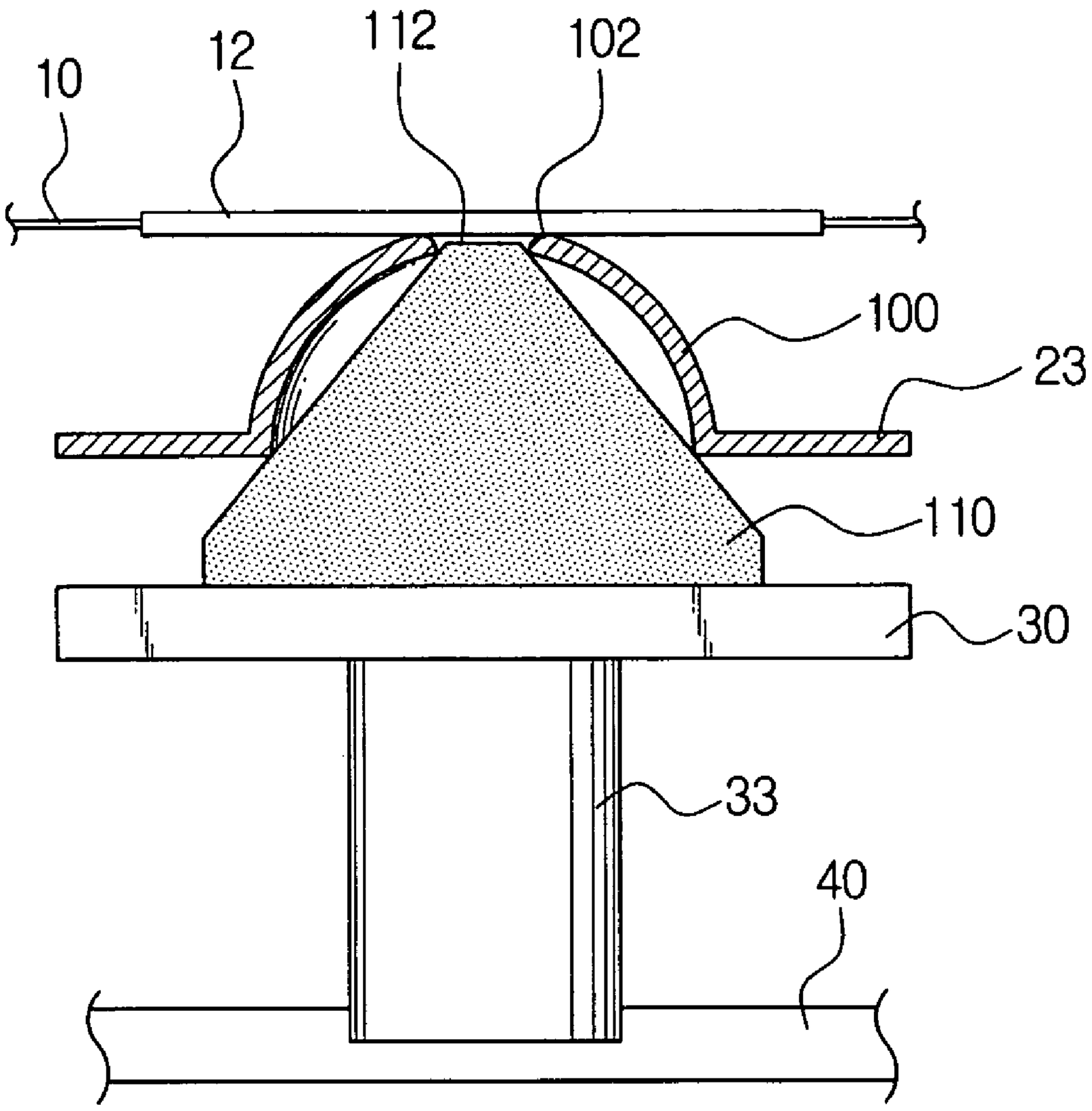


FIG. 10



PRINTING APPARATUS AND ELECTRONIC DEVICE HAVING LINE CONTACT STRUCTURE

This application claims the benefit of Korean Patent Application No. 2003-7936 filed Feb. 7, 2003 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a printing apparatus, and more particularly, to a printing apparatus in which a main body and a print head replaceable with respect to the main body are electrically connected by a flexible cable.

2. Description of the Related Art

Generally, a printing apparatus drives a print head according to input data and prints text or images on a printing paper. The print head is typically connected to a main body by a flexible cable so as to be reciprocated within a certain range. The flexible cable is formed by printing a signal line on a flexible printing plate, whereby an assembling process is facilitated.

There is high demand for a user's convenience in the maintenance of the printing apparatus. When ink is used up in an inkjet printing apparatus, for example, the print head itself, as well as an ink tank, can be replaced with new ones. Thus, the user can use the printing apparatus without concern for the short life span of the print head.

FIG. **1** shows an existing inkjet printing apparatus as an example of the printing apparatus, and FIG. **2** is a view showing a contact structure for connecting a print head to a printing apparatus.

Referring to FIG. **1**, in an inkjet printing apparatus **80**, a print head **10** integrally formed with an ink tank is mounted in a carriage **50**. The carriage **50** performs a printing operation on a printing paper, while moving left and right along a guide rod **60**. Further, a feeding unit **70** supplies the printing paper.

Referring to FIG. **2**, a flexible cable **20** and an elastic member **30** are affixed to a fixing portion **40** disposed at the carriage **50** of the printing apparatus **80**. If the print head **10** is mounted in the carriage **50**, a circuit portion **12** (FIG. **4**) of the print head **10** is in contact with an electrical connecting portion **21** of the flexible cable **20**. The electrical connecting portion **21** (FIG. **3**) of the flexible cable **20** is formed with a plurality of contact points **25** and a circuit pattern **23** corresponding to the circuit portion **12** of the print head **10**. FIG. **3** is an enlarged view showing one of the contact points **25** formed in the electrical connecting portion **21** and one of protruding portions **32** for supporting the contact point **25** in the elastic member **30**. The contact point **25** of the electrical connecting portion **21** is in the form of an empty dome, and the protruding portion **32** of the elastic member **30** is in the form of a cone. The protruding portion **32** of the elastic member **30** is placed in the hollow dome of the contact point **25** so that the contact point **25** is closely contacted with the circuit portion **12** of the print head **10**. To this end, the elastic member **30** is formed of an elastic material such as rubber. FIG. **4** is a view showing the contact point **25** of the electrical connecting portion **21** in close contact with the circuit portion **12** of the print head **10** by the protruding portion **32** of the elastic member **30**. As shown in FIG. **4**, an apex of the contact point **25** of the electrical connecting portion **21** is point-contacted with the circuit portion **12** of the print head **10** so as to press the circuit portion **12** of the print head **10** by the protruding portion **32** of the elastic member **30**. Accordingly, due to the point-contact between the circuit portion **12** of the print head **10** and the apex of the contact point **25**, an electric signal of the printing apparatus is transferred to the print head **10**, and then the print head **10** ejects ink so as to perform the printing operation.

However, because the contact point **25** of the electrical connecting portion **21** of the flexible cable **20** is point-contacted with the print head **10** in the above contact structure, if the protruding portion **32** of the elastic member **30** does not exactly press a center portion of the contact point **25**, the contact is uncertain. Thus, the signal from the main body **80** may not be transferred to the print head **10**.

In addition, when the electrical connecting portion **21** of the flexible cable **20** is assembled to the elastic member **30**, since the contact point **25** of the electrical connecting portion **21** covers the protruding portion **32** of the elastic member **30**, there is a problem that it cannot be easily confirmed whether the protruding portion **32** exactly supports the contact point **25**, i.e., whether the protruding portion **32** is apart from the center portion of the contact point **25**, as shown in FIG. **5**A, due to an erroneous assembling or size of the electrical connecting portion **21**, or whether the protruding portion **32** is assembled such that an apex of the protruding portion **32** is bent, as shown in FIG. **5**B. If the protruding portion **32** does not exactly press the center portion of the contact point **25**, a contacting pressure between the contact point **25** and the print head **10** is lowered; therefore, a contact property of the contact point **25** is degenerated. If the contact property of the contact point **25** is degenerated, product quality is also degenerated.

Therefore, a need exists for a printing apparatus in which a circuit portion of a print head is line-contacted with a contact point of an electrical connecting portion, and a worker in an assembly line can confirm, during the assembling of a protruding portion of an elastic member and the contact point when assembling the printing apparatus, that an apex of the protruding portion can be in close contact with the contact point.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide a printing apparatus with a contact structure in which a circuit portion of a print head is line-contacted with a contact point of a flexible cable.

It is another object of the present invention to provide a printing apparatus with a line-contact structure, in which an worker in an assembly line can confirm an assembling of a protruding portion of an elastic member with the contact point of the flexible cable, when assembling the printing apparatus, and the protruding portion can be configured in a desired position.

To achieve an aforementioned object of the present invention, a printing apparatus comprising a main body, a print head replaceable with respect to the main body, and a cable for electrically connecting the main body and the print head, wherein a signal from the main body is transferred to the print head, is characterized by comprising an electrical connecting portion formed at an end of the cable; a plurality of contact points formed at the electrical connecting portion and each in a form of a hollow projection, so as to be corresponded to a circuit portion of the print head, and having a hole form at an apex of the projection; a fixing portion for fixing the electrical connecting portion to the main body; and an elastic member interposed between the

electrical connecting portion and the fixing portion and having a plurality of protruding portions corresponding to the plurality of contact points, wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the print head, when the print head is mounted in the main body.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and other advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. **1** is a perspective view of a conventional printing apparatus with a contact structure between a print head and a main body;

FIG. **2** is an exploded perspective view showing the contact structure between a flexible cable and the print head of FIG. **1**;

FIG. **3** is a perspective view showing structures of a protruding portion of an elastic member and an electrical connecting portion of the flexible cable of FIG. **2**;

FIG. **4** is a partial cross-sectional view showing a contact structure between the protruding portion of the elastic member and the electrical connecting portion of the flexible cable of FIG. **3**;

FIG. **5**A is a partial cross-sectional view showing the protruding portion of FIG. **4** being apart from a center portion of the contact point;

FIG. **5**B is a partial cross-sectional view showing an apex of the protruding portion that is bent in the contact structure of FIG. **4**;

FIG. **6** is a partial enlarged perspective view showing a shape of an electrical connecting portion of a flexible cable according to an embodiment of the present invention;

FIG. **7** is a cross-sectional view of the electrical connecting portion of the flexible cable of FIG. **6**;

FIG. **8** is a partial enlarged perspective view showing a shape of a protruding portion of an elastic member according to an embodiment of the present invention;

FIG. **9** is a partial enlarged perspective view showing a relationship between the electrical connecting portion of the flexible cable and the protruding portion of the elastic member according to an embodiment of the present invention; and

FIG. **10** is a cross-sectional view showing a relationship between the electrical connecting portion of the flexible cable and the protruding portion of the elastic member of FIG. **9**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of a printing apparatus and an electronic device having a line contact according to the present invention will now be described in detail. An inkjet printing apparatus (hereinafter, called "printing apparatus") that ejects ink on a printing paper to perform a printing operation, as an example of the printing apparatuses, will be described with reference to FIGS. **6** through **10**.

Those components of the printing apparatus of the present invention that are the same as the conventional printing apparatus are designated by the same reference numerals.

For example, contact structure of a printing apparatus according to the present invention includes a circuit portion **12** of a print head **10**, an electrical connecting portion **21** of a flexible cable **20**, an elastic member **30** and a fixing portion **40** (FIG. **2**).

The circuit portion **12** of the print head **10** is formed with a circuit pattern for connecting the print head **10** with the flexible cable **20**, and the print head **10** stores ink and ejects the ink according to a signal of a main body **80** (FIG. **1**).

The flexible cable **20** for transferring the signal of the main body **80** to the print head **10** has flexibility to correspond to mobility of a carriage **50**, and the electrical connecting portion **21** is formed at an end of the flexible cable **20**.

The electrical connecting portion **21** of the flexible cable **20** is disposed at the carriage **50** provided with the print head **10**, and formed with a plurality of contact points **100** (FIG. **6**) and a circuit pattern **23** for transferring the signal from the main body **80** through the flexible cable **20** to the print head **10**. The plurality of contact points **100** is comprised of projections protruded from the circuit pattern **23** of the electrical connecting portion **21**, and inside portions of the projections are hollow. Furthermore, at an apex of the contact point **100**, there is formed a hole **102**. Circumference of the hole **102** is round-processed. Therefore, when the contact point **100** is contacted with the circuit portion **12** of the print head **10**, a round-processed portion **103** is line-contacted with the circuit portion **12**.

FIG. **6** is a partially enlarged view showing one of the plurality of contact points and a part of the circuit pattern as a preferred embodiment of the contact point of the electrical connecting portion of the flexible cable. Referring to FIG. **6**, the contact point **100** is in the form of a dome protruded from the circuit pattern **23**, and an inside portion of the dome is hollow. Further, at the apex of the dome, there is formed a circular hole **102**. In order to secure the contact between the contact point **100** and the circuit portion **12** (FIG. **10**), it is preferable that the circumference of the circular hole **102** formed at the apex of the dome is round-processed, as shown in FIG. **7**. Therefore, when the contact point **100** is contacted to the circuit portion **12** of the print head **10**, a contacted portion between the contact point **100** and the circuit portion **12** is in the form of a circle. That is, the contact point **100** and the circuit portion **12** of the print head **10** are line-contacted.

The elastic member **30** is to press the electrical connecting portion **21** at a desired pressure so that the electrical connecting portion **21** of the flexible cable **20** is closely contacted with the circuit portion **12** of the print head **10**. Accordingly, the elastic member **30** is formed of a desired elastic material and has a desired shape to elastically support each contact point **100** of the electrical connecting portion **21**. An example of the elastic member **30** is illustrated in FIG. **8**. Referring to FIG. **8**, the elastic member **30** is comprised of an intermediate plate **31** having a size corresponding to the circuit portion **12** of the print head **10** and a plurality of protruding portions **110** corresponding to the plurality of contact points **100** of the electrical connecting portion **21**. In addition, at a lower portion of each protruding portion **110** of the elastic member **30**, there is a supporting portion **33** for supporting the protruding portion **110**. The protruding portion **110** is in the form of a cone, and an apex **112** of the cone can be inserted into the circular hole **102** of the contact point **100**. Furthermore, if the apex **112** of the cone is inserted into the hole **102**, a height of the apex **112** of the cone, which is protruded from the hole **102**, has to be lower than that of the round-processed portion **103** of the hole **102** in order to prevent the cone from disturbing the contact between the contact point **100** and the circuit portion

12. In other words, there is a space between the apex **112** of the cone and the circuit portion **12** of the print head **10**. FIGS. **9** and **10** shows a preferred assembly of the contact point **100** of the electrical connecting portion **21** and the protruding portion **110** of the elastic member **30**. It is to be understood that the protruding portion **110** can have any shape in addition to that of FIG. **8**, if the shape can press the apex of the contact point **100** of the electrical connecting portion **21** toward the circuit portion **12**.

The fixing portion **40** is disposed at a place within the carriage **50**, which is contacted with the print head **10**, so as to fix the electrical connecting portion **21** of the flexible cable **20** and the elastic member **30** at a desired position. Therefore, when the print head **10** is mounted in the carriage **50**, the circuit portion **12** of the print head **10** is contacted with the contact point **100** of the electrical connecting portion **21**. At this time, the print head **10** is firmly fixed to the carriage **50** by a fixing member (not shown).

Since the constituents of the inkjet printing apparatus such as a feeding unit **70**, a carriage moving unit **75**, an exhausting unit **77** are the same as those in the conventional printing apparatus, the description thereof will be omitted.

Herein, an operation of the printing apparatus with a line contact structure according to the present invention, as described above, will be fully described with reference to FIGS. **9** and **10**.

First, a process of mounting the flexible cable **20** in the carriage **50** will be described. The elastic member **30** is disposed at the fixing portion **40** of the carriage **50**. The electrical connecting portion **21** of the flexible cable **20** is disposed on the elastic member **30**. At this time, the protruding portion **110** of the elastic member **30** is protruded through the circular hole **102** formed at the apex of the contact point **100** of the electrical connecting portion **21**. If the protruding portion **110** of the elastic member **30** is not protruded through the hole **102** of the contact point **100**, it means that the contact point **100** or the protruding portion has a defect in manufacturing, or the apex of the protruding portion **100** is bent at an inside portion of the contact point **100**, as shown in FIG. **5**B, when assembling the print apparatus. Therefore, if the protruding portions **110** of the elastic member **30** are protruded through all of the holes **102** of the contact points **100**, it means that the elastic member **30** and the electrical connecting portion **21** of the flexible cable **20** are normally assembled.

The print head **10** is disposed in the carriage **50** in which the electrical connecting portion **21** of the flexible cable **20** is mounted, as described above. Then, the circuit portion **12** of the print head **10** is contacted with the contact point **100** of the electrical connecting portion **21** disposed at the fixing portion **40** of the carriage **50**. This configuration is illustrated in FIG. **10**. Referring to FIG. **10**, the apex of the contact point **100**, i.e., the round-processed portion **103** (FIG. **9**) around the circular hole **102** is contacted with the circuit portion **12**. Accordingly, the circuit portion **12** and the contact point **100** are not in point contact with each other, but in line contact with each other, whereby the contact property is promoted. Further, since the apex **112** of the protruding portion **110** of the elastic member **30** is protruded through the hole **102** of the contact point **100**, the contact point **100** is contacted with the circuit portion **12**, while always pressing the circuit portion **12** at a constant pressure. Thus, the present invention obviates the problem whereby the contact property is degenerated by instability of contact force between the circuit portion **12** and the contact point **100** due to the protruding portion **110** of the elastic member **30** erroneously supporting the contact point **100**.

If the print head **10** is disposed in the carriage **50**, as described above, a signal is stably transferred from the main body to the print head, and a printing operation is normally performed. After that, although the print head **10** is replaced with a new one due to exhaustion of the ink of the print head **10**, since the circuit portion **12** of the print head **10** and the contact point of the flexible cable are stably contacted with each other, the printing operation can be normally performed.

According to the printing apparatus of the present invention having a line contact structure, as described above, since the contact point **100** of the electrical connecting portion **21** is in line contact with the circuit portion **12** of the print head **10**, the contact property is improved. Furthermore, since it can be confirmed whether the protruding portions of the elastic member **30** are exactly assembled to the plurality of contact points, the contact points can always press the circuit portion **12** of the print head **10** at the constant pressure, and thus the contact property is not degenerated. Therefore, the present invention obviates the problem of a printing defect due to loose contact between the print head **10** and the electrical connecting portion **21**.

The printing apparatus having a line contact structure according to the present invention can be applied to all of the printing apparatuses in which the print head **10** is separated from the main body. Further, the line contact structure of the present invention can be also applied to all kinds of electronic devices having a replaceable component which is can be replaced with respect to a main body and a structure for transferring an electric signal to the replaceable component and performing a specific function.

While the present invention has been described in detail, it should be understood that various changes, substitutions and alterations can be made hereto without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A printing apparatus comprising a main body, a print head replaceable with respect to the main body, and a cable for electrically connecting the main body and the print head, wherein a signal from the main body is transferred to the print head, the printing apparatus comprising:

an electrical connecting portion formed at an end of the cable;

a plurality of contact points formed at the electrical connecting portion, each in a form of a hollow projection so as to correspond to a circuit portion of the print head and having a hole formed at an apex of the projection;

a fixing portion for fixing the electrical connecting portion to the main body; and

an elastic member interposed between the electrical connecting portion and the fixing portion and having a plurality of protruding portions corresponding to the plurality of contact points,

wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the print head when the print head is mounted in the main body.

2. The printing apparatus of claim **1**, wherein the hole formed at the apex of each of the contact points is round-processed.

3. The printing apparatus of claim **2**, wherein each of the plurality of contact points are a dome-shaped hollow projection.

4. A printing apparatus comprising a main body, a print head replaceable with respect to the main body, and a cable

for electrically connecting the main body and the print head, wherein a signal from the main body is transferred to the print head, the printing apparatus comprising:

an electrical connecting portion formed at an end of the cable;

a plurality of contact points formed at the electrical connecting portion, each in a form of a hollow projection so as to correspond to a circuit portion of the print head and having a hole form at an apex of the projection;

a fixing portion for fixing the electrical connecting portion to the main body; and

an elastic member interposed between the electrical connecting portion and the fixing portion and having a plurality of protruding portions inserted into the holes formed at the plurality of contact points,

wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the print head when the print head is mounted in the main body.

5. The printing apparatus of claim **4**, wherein the hole formed at the apex of each of the contact points is round-processed.

6. The printing apparatus of claim **5**, wherein each of the plurality of contact points are a dome-shaped hollow projection.

7. The printing apparatus of claim **6**, wherein the protruding portion of the elastic member is in a form of a cone, and a space is formed between an apex of the cone and the circuit portion of the print head when the apex of the cone is inserted into the hole of the dome.

8. An electronic device comprising a main body, a replaceable component which is replaceable with respect to the main body, and a cable for electrically connecting the main body and the replaceable component, wherein a signal from the main body is transferred to the replaceable component, the electronic device comprising:

an electrical connecting portion formed at an end of the cable;

a plurality of contact points formed at the electrical connecting portion, each in a form of a hollow projection so as to correspond to a circuit portion of the replaceable component and having a hole form at an apex of the projection;

a fixing portion for fixing the electrical connecting portion to the main body; and

an elastic member interposed between the electrical connecting portion and the fixing portion and having a plurality of protruding portions corresponding to the plurality of contact points,

wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the replaceable component when the replaceable component is mounted in the main body.

9. The electronic device of claim **8**, wherein the hole formed at the apex of each of the contact points is round-processed.

10. The electronic device of claim **9**, wherein each of the plurality of contact points are a dome-shaped hollow projection.

11. An electronic device comprising a main body, a replaceable component which is replaceable with respect to the main body, and a cable for electrically connecting the main body and the replaceable component, wherein a signal from the main body is transferred to the replaceable component, the electronic device comprising:

an electrical connecting portion formed at an end of the cable;

a plurality of contact points formed at the electrical connecting portion, each in a form of a hollow projection so as to correspond to a circuit portion of the replaceable component and having a hole form at an apex of the projection;

a fixing portion for fixing the electrical connecting portion to the main body; and

an elastic member interposed between the electrical connecting portion and the fixing portion and having a plurality of protruding portions inserted into the holes formed at the plurality of contact points,

wherein the elastic member presses the electrical connecting portion so that the plurality of contact points are in line contact with the circuit portion of the replaceable component when the replaceable component is mounted in the main body.

12. The electronic device of claim **11**, wherein the hole formed at the apex of each of the contact points is round-processed.

13. The electronic device of claim **12**, wherein each of the plurality of contact points are a dome-shaped hollow projection.

14. The electronic device of claim **13**, wherein the protruding portion of the elastic member is in a form of a cone, and a space is formed between an apex of the cone and the circuit portion of the replaceable component when the apex of the cone is inserted into the hole of the dome.

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